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THE LARGER CORN STALK-BORER.[1]

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INTRODUCTION.

In many Southern cornfields a heavy wind late in the season, before the corn is matured, does great damage by breaking the plants off at the surface of the ground, thus ruining them. An examination of these broken stems will, in most cases, show that they have been greatly weakened by the burrows of a larva or caterpillar. This larva (fig. 1) is known as "the larger corn stalk-borer." Its work is largely within the stem of the plant and is so concealed that in most cases, unless weather conditions make it conspicuous, the presence of the insect passes unnoticed.

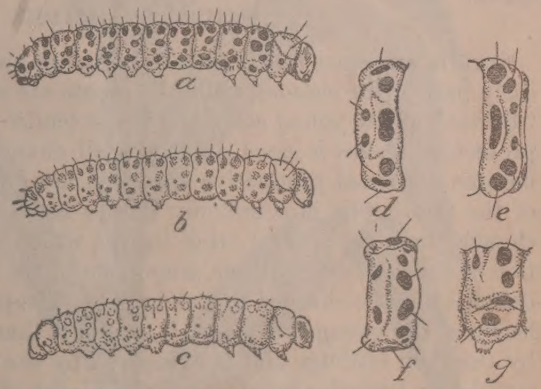

FIG. 1.—The larger corn stalk-borer: *a*, Summer form of larva; *b*, *c*, hibernating forms of larvæ; *d*, third thoracic segment from above; *e*, eighth abdominal segment from above; *f*, abdominal segment from above; *g*, same from side. *a*, *b*, *c*, Enlarged; *d*, *e*, *f*, still more enlarged. (Redrawn from Howard.)

This insect seems to have been originally an enemy of sugar cane and to have first transferred its attention to corn, in the southern part of this country, where corn and cane are grown over the same territory. It occurs in many countries where sugar cane is the staple crop, and has caused great damage in the West Indies, British Guiana, Australia, and Java. The bulk of the evidence goes to show that it was first brought into this country with the importation of sugar-cane cuttings from the West Indies and Central and South America, where, since early times, it has interfered with the production of this staple.

[1] *Diatræa saccharalis* Fab.

In the United States this borer is found almost universally throughout the South, from Maryland to Louisiana and westward to Kansas. Among other localities it has been reported from Bennettsville, S. C., as destroying corn, especially that planted early in the season. From Waynesboro, Ga., in 1909, reports were received that in some fields the corn was "at least one-third destroyed" by an insect which later proved to be this species. In Virginia it has been found recently at Nathalie, at Allenslevel, at Church Road, and at Farmville. In late October, 1909, Mr. E. G. Smyth found that nearly one-half of the cornstalks at Diamond Springs, Va., were infested, often as many as three larvæ being found in one stalk, boring from the surface of the ground down to the base of the root; and while the author has frequently found as many as a dozen larvæ in a single stalk, there are never more than two or three pupæ in the same stalk. In each case it had damaged the corn, and especially that planted early in the season.

NATURE OF DAMAGE.

Corn is damaged by these caterpillars in two ways. First, in the early part of the season, while the plants are small, they work in the "throat" of the young corn, and if the tender growing tip within the protecting leaves is once damaged, all chances that the plant will become a normal productive specimen are gone. In many sections of the South this is commonly known as "bud-worm" injury, and though there are several other insects which cause a similar mutilation of the leaf, a very large proportion of the so-called "bud-worm" damage may be charged to this insect. The effect of its work on the leaves of the young corn plants is similar to that resulting from attacks by the corn billbugs and is evidenced by the familiar rows of small circular or irregular holes across the blades of the plant (fig. 2).

The other form of serious damage chargeable to this pest occurs later in the season. The larvæ, having then left the leaves and descended to the lower part of the stalk, tunnel in the pith. (See fig. 3.) If the larvæ are at all numerous in the stalk, their burrows so weaken the plant that any unusual strain will lay it low and destroy all chance of its maturing. While frequently ten or more larvæ may live and mature in one plant, it must be remembered that any infestation, however light, will lessen in some degree the vitality of the plant and cause a corresponding loss in the quality and quantity of the harvest.

HABITS OF THE LARVÆ.

Immediately upon leaving the egg in spring, the young larva of the first generation, spinning a silken thread behind it, wanders down into the throat of the plant as far as the water or dew usually standing there will allow it to go, and begins to feed on the leaves, going back and forth through the yet unfolded clusters and soon

riddling the more tender leaves with aimless burrows. If the burrow reaches the tender terminal bud where the future joints are being formed, further growth at that point ceases and the plant becomes stunted and misshapen, with no tassel. As the plant continues to mature, the larva "grows out," as the farmers say. It is more likely that it is not the larva itself but the evidences of its work that "grow out"; but for whatever reason, the caterpillar soon leaves the more leafy portion of the plant and attacks the stalk at or near the ground. Here a hole is cut through the outer wall of the stalk

FIG. 2.—Work of larger corn stalk-borer, showing mutilation of leaves of corn by larvæ. Greatly reduced. (Author's illustration.)

and the larva burrows upward for a short distance, after which it seems to run aimlessly through the pith, frequently even leaving the stalk entirely and reentering it at another point. Turning upward, the caterpillar, when fully grown, bores toward the outside and cuts a circular hole in the outer wall of the stalk. Then, after spinning a few loose threads across this opening to keep out undesirable visitors, it retreats a short distance, plugs the burrow below with digested pith, and in the chamber thus created slowly changes to the next or pupal stage (fig. 4, *c*).

Seldom is the stalk damaged above the third joint from the ground, although the larvæ, when small, are found in the large midribs of the lower leaves and later in the season, when the food supply is restricted, even in succulent nubbins farther up. They sometimes also penetrate the underground part of the stalk in feeding and enter some of the larger brace roots for a short distance.

FIG. 3.—The larger corn stalk-borer: Larva in lower part of corn plant preparatory to hibernation. Reduced. (Author's illustration.)

The larvæ of the second generation work in a similar manner, except that at the time they appear the tassel has been formed; hence the damage is now confined altogether to the lower stalk. Thus, instead of arranging to pass the pupal stage in the upper stalk, they penetrate to the root to hibernate and there, as larvæ, pass the winter in a quiescent state (fig. 3).

SEASONAL HISTORY.

During the winter this enemy of corn is to be found as a robust, creamy-white larva of the second generation in the lower part of the stalk or of the stubble, if, as is usually the case, the corn has been cut. In this location the larva forms a small cavity below the surface of the ground, well protected from birds, predaceous insects, and unfavorable weather conditions. From the time the corn is mature in the fall until about corn-planting time in the spring this caterpillar remains inactive. About the time the ground is being prepared for corn, from March 15 to April 30, depending on the locality, this larva changes into a reddish-brown pupa or chrysalis (fig. 4, *c*). After a further period of 10 or more days' inactivity the adult insect emerges from the pupa case as a pale brownish-yellow moth (fig. 4, *a*), with a spread of wings of about an inch and a fourth. The moths then mate, and the females begin at once to deposit eggs on the underside of the leaves, the larvæ hatching from these eggs forming the first generation.

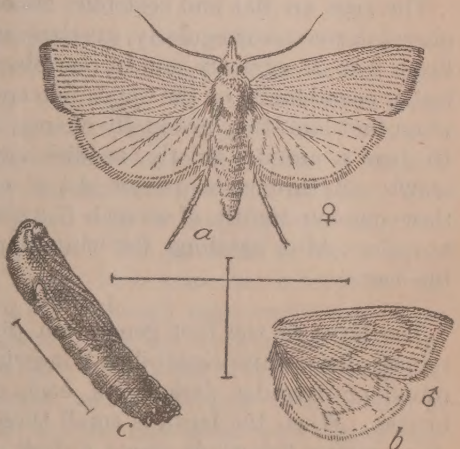

FIG. 4.—The larger corn stalk-borer: *a*, Female moth; *b*, wings of male; *c*, pupa. All somewhat enlarged. (Author's illustration.)

The eggs hatch in from 7 to 10 days and the young larvæ begin their destructive work in the upper leafy portion of the plant, later descending to the base of the stalk, where they attain full growth. This period, from egg to full-grown larva, requires from 20 to 30 days, depending largely on the weather conditions and the vigor of the plant. The larvæ when full grown pupate in the stalk, usually in the second or third joint from the ground, and in from 7 to 10 days the adult moths of the first generation emerge.

The eggs for the second generation are laid in similar positions on the lower leaves or on the stem, and the larvæ, after feeding for a short time on the leaves, go directly to work in the stalk, completing their larval growth in the pith of the lower stalk as did the larvæ of the first generation. No damage is done to the upper part of the plant by larvæ of the second generation.

By the time the larvæ of the second generation are full grown the corn is rapidly nearing maturity, and, instead of pupating in

the stalk, they turn downward, penetrate to the extreme lower tip of the taproot, and there form a small cavity in which to pass the winter. At this time the larvæ lose the darker markings of the earlier forms, and as overwintering larvæ are creamy-yellow in color. They are plump and active in the fall, but flabby and sluggish after fasting throughout the winter. The only way in which the insect passes the winter is in the form of this overwintering larva, found below the ground in the extreme lower tip of the corn roots. Two generations a year appear to be the rule, although it is possible that in the far South and on sugar cane a partial third generation may occur.

DESCRIPTIONS.

EGG.

The eggs are flat and scalelike, almost circular in outline, and are placed in rows or irregularly, overlapping one another shingle fashion. From 2 to 25 eggs are laid in one place on the underside of a lower leaf or occasionally on the upper side and on the stem. Creamy-white when first laid, they gradually change to a reddish-brown, and in 7 to 10 days a minute, bristly, reddish caterpillar cracks the shell and crawls out through a narrow slit at one end. The eggs are about three one-hundredths of an inch (7.6 mm.) long and about two-thirds as wide. After hatching, the white papery shells are soon washed off the leaves.

LARVA.

The larva of the first generation (fig. 1, *a*) when full grown is a robust, dirty-white caterpillar 1 inch in length, thickly covered with round or irregular dark spots, each of which bears a short, dark bristle. When the larva is small these markings are almost contiguous, giving the whole insect a dark color and a hairy appearance. The head and thoracic plate of all the stages are brownish-yellow. The overwintering larva of the second generation (fig. 1, *b*, *c*) gradually loses the darker markings of the body and after the last molt remains unspotted and light yellow in color, except for the head and the thoracic plate, which retain the brownish-yellow of the earlier stages.

PUPA.

When first formed, the pupa (fig. 4, *c*) is light honey-yellow in color, soon changing to a rich mahogany-brown. It is about seven-eighths of an inch in length and is able to contort itself violently when disturbed. It lies in the cavity, usually with the head up. On emerging, the moth leaves the brownish shell of the pupa case partially withdrawn from the hole.

ADULT.

The female moth (fig. 4, *a*) varies in color from almost white to smoky yellow. The fore wings, which spread to about 1¼ inches,

are darker than the hind wings, and bear faint markings. When at rest the wings are held close to the body, forming an acute triangle. The egg laying is done for the most part either at night or in the dusk of evening, the moths flying rapidly from plant to plant. The male moth is usually somewhat darker in color than the female and always smaller.

FOOD PLANTS.

Besides corn and sugar cane, this borer has been reported as feeding on sorghum, Johnson grass, guinea corn, and grama grass. The injury to the four last-mentioned plants is never severe, but in planning methods of control they must be considered and an examination made to determine whether or not they are harboring the pest.

NATURAL CHECKS.

The larger corn stalk-borer has very few natural enemies. A minute hymenopterous parasite [1] has in a very few instances been found living in and destroying the eggs. In one case 10 of these minute parasites were reared from two eggs. The larva of a brown velvety beetle [2] sometimes enters the holes in the stalks of stubble after the corn is cut and devours the caterpillars found therein. This larva has been found to be of great value in reducing the numbers of the borers in fields of sugar cane. The termites or white ants,[3] locally known as "wood lice," have been observed destroying the larvæ in the stubble in the winter, although apparently only when the presence of the larvæ interfered with the work of the ants. In a few cases bodies of the borers have been found in the stubble killed by a fungus, as yet undetermined, which envelops their bodies in a white mold. Fungi, however, are too dependent on weather conditions to be of any practical value in controlling the pest.

PREVENTIVE MEASURES.

Rotation is one of the best general preventives of injury from insects affecting field crops. Experience has shown that where corn has followed itself upon the same field for two or more years there has been a much greater loss from the borer than where an annual change of crop has been practiced. This is especially noticeable where stalks or stubble from the previous year have been allowed to remain undisturbed throughout the winter. The moths, upon emergence in the spring, finding themselves surrounded by the young corn, commence egg laying at once, and escape the dangers encountered in searching for another field of corn. A forced journey in search of young corn results in many of the females being eaten by birds or being destroyed because of rain, cold, or failure to find the object of their quest. A few moths will always succeed in their search, but the

[1] *Trichogramma pretiosa* Riley.
[2] *Chaulioguathus pennsylvanicus* De G.
[3] *Leucotermes* spp.

successful proportion will be greatly decreased by persistent crop rotation.

Another remedy, probably the best for this insect, is the thorough destruction, some time before the period of emergence of the moths in the spring, of all the stalks and stubble remaining in the field from the preceding crop. If all this trash can be disposed of before the opening of spring, the numbers of the pest must be greatly diminished if not almost exterminated, for the only form in which the insect passes the winter is that of the caterpillar, and the only known location is in the lower tip of the corn root, snugly hidden. Some few may, however, be found to survive in the roots of the larger grasses mentioned above, and care should be taken in such cases to treat these in the same way. The method employed in disposing of the stubble and stalks will depend largely on the conditions in individual cases. If the stubble is cut low and the land is moderately heavy, a thorough deep plowing may suffice, an inch or two of well-settled soil being sufficient to prevent the escape of the adult moths. Bringing the stubble to the surface where it can dry will kill some of the contained larvæ, but this method depends too much on the state of the weather to be trusted. By far the most effective plan is to remove the stubble from the field with a rake and burn it.

In the cane field the methods of treatment must be adjusted to correspond with the methods of handling that crop. The larvæ commonly spend the winter in the trimmings and tops which have been discarded at harvest time because of immaturity. This refuse, left on the ground throughout the winter, becomes dry and inflammable and, if thoroughly burned before spring, enough larvæ will be killed to insure at least temporary relief from the ravages of the borer.

Any method which will insure the complete destruction of the overwintering larvæ, if persisted in and carried out simultaneously over large sections of the country, will effectually preclude serious damage from the insect.

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